WE CLAIM:

1. A method for applying a solid lubricant coating to a substrate, comprising:

a) preparing a surface of said substrate;

b) thereafter, applying a precursor material to said surface of said substrate, wherein said precursor material comprises at least one inorganic bonding component; and

c) forming said solid lubricant coating, on said surface, from said precursor material; wherein said step c) comprises melting said at least one inorganic bonding component *in situ* on said substrate surface, whereby said solid lubricant coating is bonded to said surface of said substrate.

2. The method of claim 1, wherein said step a) comprises chemically etching said surface of said substrate.

3. The method of claim 1, wherein said step a) comprises oxidizing said surface of said substrate.

4. The method of claim 1, wherein said at least one inorganic bonding component comprises at least one eutectic mixture, and wherein said precursor material further comprises at least one wear-resistant component and at least one friction-reducing component.

5. The method of claim 1, wherein said substrate comprises a top foil of a foil bearing.

6. A solid lubricant coating prepared according to the method of claim 1.

7. A foil bearing including said solid lubricant coating according to claim 6, wherein said foil bearing comprises a top foil and a shaft, and wherein at least one of said top foil and said shaft includes said solid lubricant coating bonded thereto.

8. A gas turbine engine including said foil bearing as recited in claim 7.

9. An aircraft including said gas turbine engine as recited in claim 8.

10. A method for forming a solid lubricant coating from a precursor material on a substrate surface, the method comprising:

a) applying said precursor material to said substrate surface, said precursor material comprising a plurality of inorganic components and an organic polymer binder, said plurality of inorganic components including at least one bonding component;

b) thereafter, removing said organic polymer binder from said precursor material; and

c) thereafter, via said at least one bonding component, bonding said plurality of inorganic components to said substrate surface.

11. The method of claim 10, wherein said step a) comprises applying said precursor material to said substrate surface as a paste having a viscosity of from about 100,000 to 250,000 Centipoise.

12. The method of claim 10, wherein said step a) comprises applying said precursor material to said substrate surface via thick film screen printing or tape transfer.

13. The method of claim 10, wherein said precursor material further

comprises a solvent, and the method further comprises:

d) prior to said step b), removing said solvent by heating said precursor material to a temperature of from about 100 to 150° C.

14. The method of claim 10, wherein said step b) comprises heating said precursor material to a temperature below a melt temperature of said at least one bonding component.

15. The method of claim 10, wherein said step b) comprises heating said precursor material to a temperature of from about 350 to 450° C.

16. The method of claim 10, wherein said at least one bonding component includes at least one eutectic mixture, and wherein said step c) comprises heating said precursor material to a melt temperature of said at least one eutectic mixture.

17. The method of claim 10, wherein said step c) comprises heating said precursor material, at a rate of from about 5 to 20° C per minute, to a melt temperature of from about 600 to 700° C.

18. The method of claim 16, further comprising:

e) after said step c), cooling said substrate surface to ambient temperature at a rate of about 5 to 10° C per minute.

19. A method for forming a solid lubricant coating on a substrate, comprising:

a) providing said substrate;

b) preparing a surface of said substrate;

c) providing a precursor material, wherein said precursor material comprises a plurality of inorganic components, a polymer binder, and a solvent; said plurality of inorganic components including at least one bonding component, at least one wear-resistant component, and at least one friction-lowering component;

d) after said step b), applying said precursor material to said surface;

e) heating said precursor material, *in situ*, on said surface to a first temperature sufficient to remove said solvent from said precursor material;

f) thereafter, heating said precursor material, *in situ*, on said surface to a second temperature sufficient to remove said polymer binder from said precursor material;

g) heating said precursor material, *in situ*, on said surface to a third temperature sufficient to melt said plurality of inorganic components on said surface; and

h) cooling said plurality of inorganic components on said surface, whereby said solid lubricant coating is bonded to said surface.

20. The method of claim 19, wherein said substrate comprises a superalloy, and wherein said step b) comprises chemically etching said surface or oxidizing said surface.

21. The method of claim 19, wherein said precursor material comprises a paste having a viscosity of from about 50,000 to 300,000 Centipoise, and wherein said step d) comprises applying said paste to said surface via thick film screen printing or tape transfer.

22. A method for applying a solid lubricant coating to a substrate surface, comprising:

a) applying a first precursor material to said substrate surface, wherein said first precursor material comprises a first plurality of inorganic components and a plurality of organic constituents;

b) removing said plurality of organic constituents from said first precursor material;

c) heating said first plurality of inorganic components to a melt temperature of said first plurality of inorganic components, wherein said first plurality of inorganic components includes at least one eutectic mixture; and

d) bonding said first plurality of inorganic components to said substrate surface to form a first layer of said solid lubricant coating on said substrate surface.

23. The method of claim 22, further comprising:

e) after said step d), applying at least a second precursor material to said first layer of said solid lubricant coating, wherein said second precursor material comprises a second plurality of inorganic components and said plurality of organic constituents;

f) removing said plurality of organic constituents from said second precursor material, *in situ*;

g) heating said second plurality of inorganic components to a melt temperature of said second plurality of inorganic components; and

h) bonding said second plurality of inorganic components to said first layer of said solid lubricant coating to form at least a second layer of said solid lubricant coating on said first layer of said solid lubricant coating.

24. The method of claim 23, wherein said first precursor material has a first composition, said second precursor material has a second composition,

and wherein said first composition is different from said second composition.

25. A method for making a precursor material, comprising:

a) providing inorganic components of said precursor material, wherein said inorganic components comprise:

i) at least one bonding component,

ii) at least one wear-resistant component, and

iii) at least one friction-lowering component; and

b) combining said inorganic components with a polymer binder and a solvent to provide said precursor material, wherein said at least one bonding component comprises at least one eutectic mixture, and wherein said precursor material has a viscosity of from about 50,000 to 300,000 Centipoise.

26. The method of claim 25, wherein said step a) comprises forming a powder mixture of said inorganic components, said powder mixture having a particle size in the range of about 10 microns or less.

27. The method of claim 25, wherein said b) comprises:

c) dissolving said polymer binder in said solvent to provide a solution of said polymer binder; and

d) combining said solution of said polymer binder with said inorganic components.

28. The method of claim 25, wherein said polymer binder comprises ethyl cellulose or nitrocellulose.

29. The method of claim 25, wherein said solvent comprises terpineol.

30. The method of claim 25, wherein said at least one eutectic mixture is selected from the group consisting of silver sulfide/copper sulfide, silver

sulfide/lead sulfide, silver sulfide/bismuth sulfide, nickel oxide/vanadium pentoxide, and calcium fluoride/magnesium fluoride.

31. The method of claim 25, wherein said at least one wear-resistant component comprises at least one metal oxide selected from the group consisting of nickel oxide, aluminum oxide, chromic oxide, and barium oxide.

32. The method of claim 25, wherein said at least one friction-lowering component is selected from the group consisting of a metal fluoride, a metal sulfide, and a precious metal.

33. A precursor material, comprising:

at least one bonding component comprising at least one eutectic mixture, said at least one eutectic mixture comprising a metal sulfide or a metal oxide;

at least one wear-resistant material;

at least one friction-lowering material selected from the group consisting of precious metals, metal fluorides, and metal sulfides; and

an organic polymer binder.

34. The precursor material of claim 33, further comprising an organic solvent.

35. The precursor material of claim 33, wherein said organic polymer binder comprises ethyl cellulose or nitrocellulose.

36. The precursor material of claim 33, wherein said at least one eutectic mixture comprises a metal sulfide or a metal oxide, and wherein said at least one eutectic mixture has a melt temperature of from about 600 to 700 °C.

37. The precursor material of claim 33, wherein said precursor material has a viscosity of from about 100,000 to 250,000 Centipoise.

38. A solid lubricant coating prepared from the precursor material as recited in claim 33.

39. A component comprising a superalloy substrate, said superalloy substrate having bonded thereto said solid lubricant coating as recited in claim 38.